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December 1, 2008

**PENNSYLVANIA BULLETIN NO. PA 180-9-1**

**SUBJECT: CPA – Estimating Sheet and Rill Erosion**

**Purpose: To provide guidance on using realistic values for slope lengths and percent of slope (grade) in calculating soil erosion estimates.**

**Expiration Date: December 31, 2009**

**Action required by: December 31, 2008**

NRCS makes estimates of soil erosion by water as part of its technical assistance to land users, Conservation Districts and other Government agencies. Soil loss estimates are used to inventory the condition of the natural resources, evaluate the effectiveness of conservation programs and land treatment, and estimate sediment production from fields that might become sediment yield in watersheds. It is important that NRCS employees use realistic values for slope lengths and percent of slope (grade) in calculating soil erosion estimates.

When making soil erosion estimates caution should be used in selecting the proper factors for slope length and slope steepness; L and S respectively. Inaccurate estimates of either of these two factors can result in significant errors in estimating the actual erosion of a particular site.

Calculating soil loss estimates for a particular field is best done by an onsite evaluation. Several slopes are typically shot until the planner determines what common length and percent slope is representative of the landscape in question. The accuracy of most topographic maps is not adequate to determine percent or length of slope in the office.

**For the purpose of estimating soil erosion:**

**Determining slope percent:** Slope is always measured along the profile perpendicular to the contour or directly up and down the slope in the direction that gravity forces the water to run. Slope percents can be measured using a hand level, clinometer or Abney level. Another person or other device is used to establish the “eye height” at a point on the slope, and is placed at either the top or bottom of the slope to measure the percent of slope.

**Determining slope lengths:** Slope lengths are measured along the profile perpendicular to the contour line, starting at the origin of overland flow near the top of the hill slope and terminating at either a) the point where significant deposition begins or b) where sheet and rill flow concentrates into a larger channel or gully. Slopes are generally shorter on low gradients, longer at moderate



gradients and shorter again on steeper gradients. This is due to the fact that flow tends to spread out and be more diffuse at low gradients, and tends to become more concentrated at steeper gradients. Concentrated flow channels tend to form higher on the slope as gradients increase, thus slope lengths tend to be shorter since they terminate at these concentrated flow channels rather than at depositional areas. RUSLE2 and previous erosion models, including USLE do not estimate gully or ephemeral gully erosion – they are confined to sheet and rill erosion. Thus, slope lengths are restricted to the erosion processes modeled by the program.

Slope Length Restrictions for PA: In Pennsylvania, slope length values are generally from 100 feet to 300 feet. Slope lengths longer than 300 feet are not to be used in erosion estimates without approval of the State Resource Conservationist. While there are hill slopes that are long – in fact very long, 1000 feet or more, current erosion models only addresses sheet and rill erosion processes. It is improbable that sheet and rill erosion would extend past 300 feet before becoming concentrated and resulting in ephemeral or gully erosion.

Required Action: NRCS field supervisors are to meet with field office employees by January 31, 2009 and emphasize the proper use of slope percent and slope length in making soil erosion estimates in conservation planning or for conservation program purposes. Soil erosion estimates for conservation planning, resource inventories and other program determinations are to be checked in field reviews and ongoing Quality Assurance activities.

Questions on estimating soil loss in conservation planning, and the use of NRCS erosion models, including the proper use of slope lengths and percent of slope (LS) factors should be directed to Dan Dostie, State Resource Conservationist.

/s/ Craig R. Derickson

CRAIG R. DERICKSON  
State Conservationist

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